INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530 /2004 /06–3–452–454
http://www.ijab.org

Integrated Pest Management of Mango against Mealy Bug and Fruit Fly

MUHAMMAD ISHAQ, MUHAMMAD USMAN[1], MUHAMMAD ASIF AND I.A. KHAN†
Institute of Horticultural Sciences, University of Agriculture, Faisalabad–38040, Pakistan
†*Department of Crop Science, College of Agriculture, Sultan Qaboos University, Oman*
[1]Corresponding author's e-mail: muhammadusm@hotmail.com

ABSTRACT

Mango mealy bug and fruit fly are serious pests of mango and are difficult to control by insecticides. Testing several treatments developed an IPM strategy. The sticky bands along with burning and burying treatments significantly reduced the incidence of infestation by mango mealy bug (0.00-15.79%). Burlap bands reduced population of mango mealy bug nymphs by 78.98%. Methyl eugenol traps were extremely effective to trap and kill fruit fly. Stem injection could achieve a very high level of mortality of sucking insects (98%). The mortality rates achieved with insecticide sprays were up to 55%. The non-chemical methods have been found superior in mealy bug and fruit fly control.

Key Words: Mango; IPM; Mealy bug; Fruit fly

INTRODUCTION

The Mango (*Mangifera indica* L.) member of family Anacardiaceae, is one of the most important tropical fruits of the world. Pakistan is standing at 5th place by contributing 916.4 MT mango, which is 3.9% in the total world production (FAO, 2001; MINFAL, 2002). Mango production has been threatened by insect and disease problems. Mango mealy bug and fruit fly are two most serious insect pests of mango in Pakistan. The mango mealy bug is a polyphagous insect, which has been recorded to feed on numerous plant species. There are numerous species of mealy bugs (Green, 1908). The species prevalent in Pakistan is *Drosicha stebbingi* Green. Similarly, there are more than 4000 species of fruit flies distributed all over the world. Among these, two species, *Dacus zonatus* and *Dacus dorsalis* are the serious pest of mango in Pakistan. In addition to mango, these fruit flies attack several other fruit and vegetable crops.

Chemical control methods for mealy bug and fruit fly have been inefficient (Tandon & Lal, 1980; Yousuf & Ashraf, 1987). There has been consistent interest to evolve cultural and biological control methods. Yousuf (1993) reported use of polyethylene bands for effective control of mealy bug. Several predators of mango mealy bug have been identified (Syed *et al*., 1970; More & Cross, 1993; Boavida *et al*., 1995; Bokonon & Neuenschwander, 1995). The fruit flies have been eliminated by the use of pheromone traps and other male annihilation methods (Steiner & Larches, 1955; Steiner *et al*., 1965; Ushio *et al*., 1982).

In this paper, data on a series of experiments conducted to evaluate different cultural, biological and chemical methods of controlling mealy bug and use of methyl eugenol impregnated insect traps for fruit fly control have been reported.

MATERIALS AND METHODS

Mango mealy bug. There were 11 treatments divided into four categories as following:

1. Chemical control

(i) Spray: T1= Folidol @ 0.4% as a spray, T2 = Metasystox @ 0.4% as a spray, **(ii) Stem injection:** T3 = Folidol @ 0.20 mL active ingredients per meter of stem girth injected 1 m above the ground in a drilled hole, T4 = Metasystox @ 0.20 mL active ingredients per meter of stem girth injected 1 m above the ground in a drilled hole, **(iii) Soil treatment:** T5 = BHC dusting @ 15 kg per hectare

2. Biological control. T6 = Burlap bands: 20 cm wide gunny bag strips were put around the trunk of mango trees at 1.5 m above the ground on 1st of June to encourage the population of *Sumnius renardi*, the predator of mango mealy bug. The predator population was monitored for the next 12 months and the mango mealy bug population was recorded during the period from January to April.

3. Cultural control. T7 = Egg exposure: the eggs were exposed three times during June-August period. In the following January, 30 x 30 x 30 cm soil samples were taken at depths of 15 cm and mealy bug population was recorded. The control plots were left undisturbed, T8 = Soil removal: Soil layer up to 25 cm depth from a radius of 1.25 m around the tree trunks was removed in the month of July and buried in a deep pit away from the orchard. The controls were left undisturbed.

Fig. 1. Response of different treatments on female Mango Mealy Bug population (%)

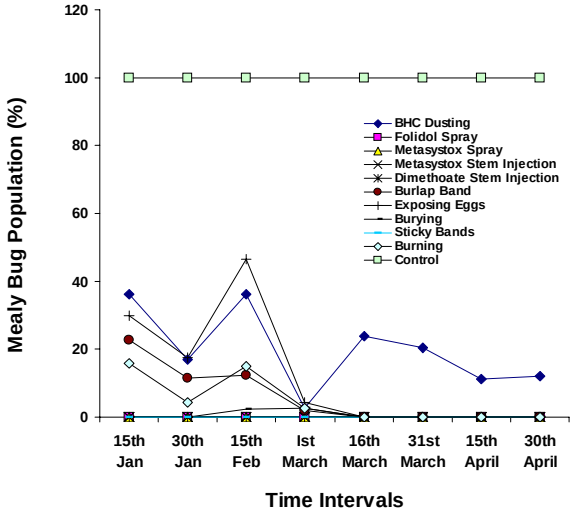


Fig. 2a. Different species of male fruit flies trapped by methyl eugenol per trap

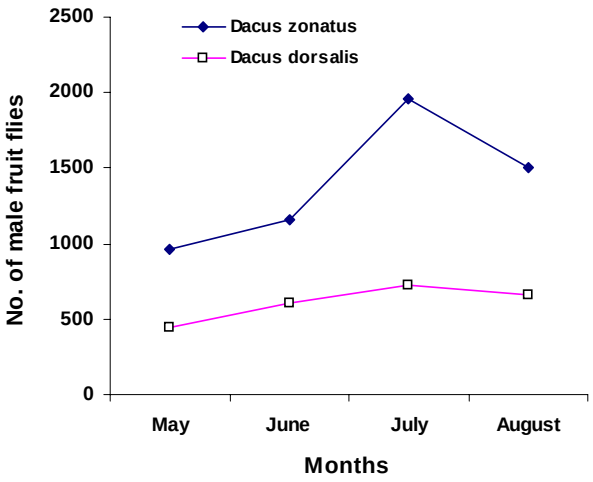


Fig. 2b. Comparison of infestation (%) by male fruit flies

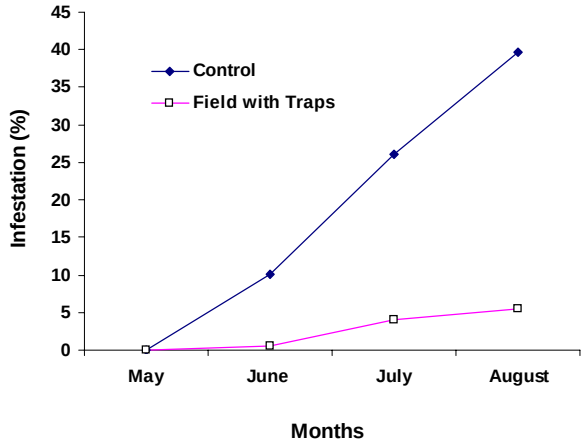
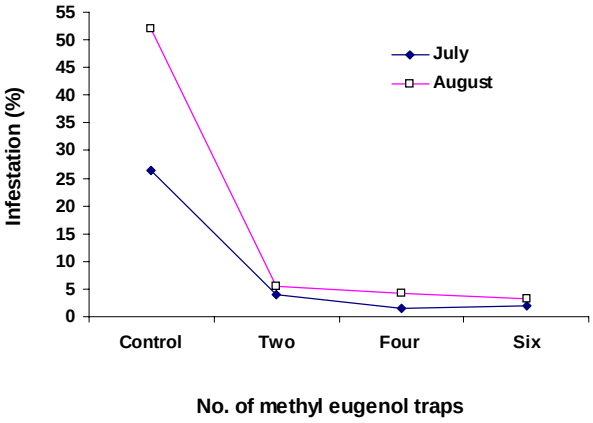


Fig. 2c Fruit infestation (%) by male fruit flies



4. Mechanical control. T9 = Sticky bands: Polyethylene strips 15 cm in width were wrapped around the trees and nailed by the end of December. Then, the strips were greased to trap the crawling nymphs, T10 = Burning: During the month of May, females gathered along the sticky bands were collected and burned. T11 = Control: For every set of treatments, there were untreated controls.

Mango fruit fly. Methyl eugenol traps were installed at three locations at different frequencies. The trap consisted of a plastic box measuring 13 x 22 cm fitted with two open tubes. A cotton swab moistened with methyl eugenol was placed inside the tubes and replaced every two weeks. The traps were hung at a height of 2 m. The infestation of fruits was recorded from a randomly selected sample of 100 fruits during the months of May to August. The frequency of traps was as under: T1 = Two traps per hectare, T2 = Four traps per hectare, T3 = Six traps per hectare, T4 = Control.

RESULTS AND DISCUSSION

Mango mealy bug. Studies on the phenology of mango mealy bug have shown that during its life cycle, it diapauses as eggs in the soil which remain dormant for nearly six months. The spatial and temporal separations in the life

cycle of this insect provide an opportunity to apply a range of cultural, biological and chemical control measures alone or in combinations.

Simple cultural methods of ploughing/hoeing to expose the eggs, burning of eggs, and physical destruction, are more effective than the traditional chemical control of dusting with BHC (85.05 & 99.34%) control with respect to 87.88% with B.H.C (Fig. 1). The population of parasitizing females can be reduced significantly by such cultural methods. The efficiency of cultural methods can be augmented further by the application of physical barriers like sticky bands. One sticky band per tree, applied during the month of December was significantly better than the controls in restricting the mealy bug movement upwards and gave 99.87% control as compared with the control treatment. These findings agree with the Atwal (1972) and Yousuf (1993) who also found the similar results of these treatments for the control of mango mealy bug.

Once the pest reaches the foliage of tree, then the best approach is to apply systemic insecticides through trunk injections. Two insecticides were tested in this study by two application methods i.e. spray and trunk injections. The injections were significantly superior in control over the spray methods as there was no fear of being washed out by rain and harmless to the natural enemies of the mango pests. These findings agree with the findings of Sandhu *et al.* (1979) and Khan (1985) who found a significant reduction in the infection and recommended this method as simple and effective to control all kinds of sucking insect pests of mango.

Experiments were also conducted on use of predator named *Sumnius renardi*, which has the ability to congregate inside the tree bark and other physical cavities. Burlap wraps were used to provide protection to congregating predator, which resulted in the survival of a large population of this predator. The predator feeds on climbing nymphs of the mealy bug and effectively reduced the population of climbing mealy bugs by 84.09% (Fig. 1).

Fruit fly. Fruit fly monitoring data revealed that the male adults of the two species could be trapped all-year-around. The counts reach economic threshold level by the month of May, which was also the time for flies to attack the developing fruits. A strong trend was indicated in population build-up and infestation of fruits as the season progresses from the month of May to August with a peak in the month of July. The population density of *D. zonatus* was significantly higher than the *D. dorsalis* (Fig. 2a, b).

The relationship between number of traps and percent infestation of fruits was determined by engaging 2, 4 and 6 traps per hectare. A linear increase was depicted in the number of flies trapped with the increasing number of traps and a corresponding reduction in the infestation of fruits (Fig. 2c). Our data on the use of methyl eugenol traps provide significant information on the use of this non-hazardous method of fruit fly control. Our results agree with the findings of Ibrahim (1979), Qureshi *et al*. (1976) and Qureshi *et al*. (1981) who observed almost the similar results for the control of mango fruit fly.

Acknowledgment. This work was financed by Pakistan Agricultural Research Council, Islamabad under ARP-II program, for which authors are grateful.

REFERENCES

Boavida, C., P. Neuenschwander and H.R. Herren, 1995. Experimental assessment of the impact of the introduced parasitoid *Gyranusoidea tebygi* Noyes on the mango mealybug *Rastrococcus invadens* Williams by exclusion. *Biocontrol*, 5: 99–103

Bonkon-Ganta, A.H. and P. Neuenschwander, 1995. Impact of the biological control agent *Gyranusoidea tebygi* Noyes on mango mealy bug *Rastrococcus invadens* Williams in Benin. *Biocontrol*, 5: 95–7

FAO Production Yearbook, 2001. *Food and Agricultural Organization of the United Nations*, Rome

Green, E.E., 1908. Remarks of Indian scale insects (*Coccidae*) part-III with a catalogue of all species hitherto recorded from the Indian continent. *Memo Dept. Agri. India* (*Entomol. Ser.*), 2: 15–46

Ibrahim, A.G., G. Singh and H.S. King, 1979. Trapping of the fruit flies, *Dacus* spp. with methyl eugenol in the orchards. *Pertnanika*, 2: 58–61. (*Biol. Abst.*, 70 (5–6): 3802, 1980)

Khan, S.M., 1985. Chemical control of insect pests of mango and its malformation by injection method. *M.Sc. Thesis*, University of Agriculture, Fasialabad, Pakistan

MINFAL, 2002. *Agriculture Statistics of Pakistan*. Govt. of Pakistan, Min. of Food, Agri. and Livestock Economic Wing, Islamabad

Moore, D. and A.E. Cross, 1993. Biological control of the fruit tree mealy bug, *Rastrococcus invadens* Williams. *Acta Hort.*, 341: 433–40

Qureshi, Z.A., A.R. Bugio, Q.H. Siddiqui and Najeeb-Ullah, 1976. Efficiency of methyl euginol as a male attractant for *D. zonatus* (Saud), Diptera: Tephritidae. *Pakistan J. Sci. Ind. Res.*, 19: 22–3

Qureshi, Z.A., A.R. Bughio and Q.H. Siddiqui, 1981. Population suppression of fruit fly, *Dacus zonatus* (Sand) (Dipt. Teph) by male annihilation technique and its impact on fruit infestation. (Sonderduck and Bd. 91, H.5. 5-521524 "Zeitschrift fur angewante Entomologic)

Sindhu, G.S., A.H. Sohi, R.C. Batra and J.S. Bhalla, 1983. Stem injection for the control of mango pests with particular reference to mango mealy bug *Drosicha mangifera* (Gr.) (Margarodidae: Hemiptera). *Gujrat Agri., Univ. Res. J.*, 9: 14–8

Steiner, L.E., W.C. Mitchell, E.J. Harris, T.T. Kozuma and M.S. Fujimoto, 1965. Oriental fruit fly eradication by male annihilation. *J. Econ. Ent.*, 58: 961–4

Steiner, L.F. and L. Larches, 1955. A test of male annihilation method for oriental fruitfly control. *J. Econ. Ent.*, 48: 311–7

Syed, R.A., M.A. Ghani and M. Murtaza, 1970. Studies on the *Trypetides* and their natural enemies in West Pakistan III. *Tech. Bull. Common Wealth Inst. Biol. Control*, 13: 1–16

Tandon, P.L. and B. Lal, 1980. Control of mango mealybug *Drosicha mangiferae* Green by application of insecticides in soil. *Entomol.* 5: 67–9

Ushio, S.K., Yoshika, K. Nakasu and K. Waki, 1982. Eradication of oriental fruit fly from Amami Island by male annihilation. *Japinees. J. Appl. Ent. Zool.*, 26: 1–9

Yousuf, M., 1993. Mango mealy bug control with polyethylene bands. *Pakistan Entomol.*, 15: 129

Yousuf, M. and M. Ashraf, 1987. Effect of some organophosphates on major insect pests of mango by stem injection. *Pakistan Entomol.*, 9: 9–12

(Received 20 December 2003; Accepted 12 February 2004)